

Attachment 9

Y-12 National Security Complex Biological Monitoring and Abatement Program—2018 Calendar Year Report



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Cover photo: *Biological Monitoring and Abatement Program staff collecting fish in East Fork Poplar Creek, Oak Ridge, Tennessee. Photo taken on September 12, 2011, by J. Miles Cary/Knoxville News Sentinel. Used by permission.*

Environmental Sciences Division

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AND ABATEMENT PROGRAM—2018 CALENDAR YEAR REPORT**

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Fish communities

The fish communities in Bear Creek were sampled in spring and fall 2018 using established multiple pass depletion methods; results are reported in Tables A.1 and A.2. The fish communities generally have been relatively stable in terms of species richness across all sites (Figs. A.6 and A.7), with the lower sites experiencing a slight increase in species in the last 10 years. The site furthest downstream (BCK 3.3) continues to have species richness values higher than a smaller reference stream (Mill Branch kilometer [MBK] 1.6), but these values are substantially lower than those of a larger reference stream (Brushy Fork kilometer 7.6), indicating that there is still some improvement expected in the fish communities. The sample site in the middle section of Bear Creek (BCK 9.9) continues to maintain species richness comparable with the smaller reference stream conditions, aided perhaps in recent years by the bypass of the downstream weir near BCK 4.6 that allows more upstream migration of fish species. Recent remediation activities at the BCK 12.4 site to restore about 300 feet of the channel to a more natural state have the end goal of providing additional species diversity and density of sensitive species. BCK 12.4 and NT3 fish communities appear to have recovered from the summer of 2016 drought conditions. In general, the fish communities in these small headwater sites are easily influenced by sedimentation and siltation (e.g., construction activities), below-normal rainfall conditions, or contaminated groundwater plume-related effects. Several species that regularly inhabit these areas are interdependent, and any impact that influences one species also could affect others. One example of this is the Tennessee dace (*Chrosomus tennesseensis*), which is listed in the state of Tennessee as “In Need of Management.” This fish relies on other nest-building species such as large-scale stonerollers (*Campostoma oligolepis*) or creek chubs (*Semotilus atromaculatus*) for spawning habitat. Despite the drought conditions, the fish populations in all Bear Creek sites showed signs of recovery in 2018 samples.

Table A.1. Species richness, density (number of fish/m²), and biomass (g/m², in parentheses) for fish community samples from Bear Creek; Bear Creek North Tributary 3; and the reference streams Brushy Fork, Mill Branch, and Pinhook Branch, March/April 2018

Species	BCK 12.4	BCK 9.9	BCK 3.3	NT3	BFK 7.6	MBK 1.6	PHK 1.6
Lampreys							
American brook lamprey	-	-	-	-	<0.01	-	-
<i>Lampetra appendix</i>					(0.01)		
Minnows							
Largescale stoneroller	-	0.45	0.18	-	<0.01	0.01	-
<i>Campostoma oligolepis</i>		(1.36)	(1.28)		(0.01)	(0.29)	
Bigeye chub	-	-	-	-	0.01	-	-
<i>Hybopsis amblops</i>					(0.01)		
Striped shiner	-	0.56	0.09	-	0.05	0.01	-
<i>Luxilus chrysocephalus</i>		(2.13)	(1.14)		(0.57)	(0.12)	
Fathead minnow	-	0.01	-	-	-	-	-
<i>Pimephales promelas</i>		(0.05)					
Scarlet shiner	-	-	0.01	-	0.02	-	-
<i>Lythrurus fasciolaris</i>			(0.01)		(0.01)		
Tennessee dace	0.06	<0.01	-	-	-	-	0.25
<i>Chrosomus tennesseensis</i>	(0.04)	(<0.01)					(0.31)
Tennessee dace hybrid	-	-	-	-	-	-	0.01
							(0.01)

Table A.1 (continued)

Species	BCK 12.4	BCK 9.9	BCK 3.3	NT3	BFK 7.6	MBK 1.6	PHK 1.6
Minnows (continued)							
Western blacknose dace	2.20	0.30	0.06	0.47	<0.01	0.02	0.49
<i>Rhinichthys obtusus</i>	(2.03)	(0.51)	(0.06)	(0.91)	(<0.01)	(0.09)	(1.13)
Creek chub	-	0.07	0.01	0.24	-	0.02	0.22
<i>Semotilus atromaculatus</i>		(0.66)	(0.02)	(1.04)		(0.14)	(0.98)
Suckers							
White sucker	-	0.06	-	-	-	0.01	-
<i>Catostomus commersonii</i>		(0.74)				(0.64)	
Northern hogsucker	-	-	0.02	-	<0.01	-	-
<i>Hypentelium nigricans</i>			(0.18)		(0.26)		
Spotted sucker	-	-	-	-	<0.01	-	-
<i>Minytrema melanops</i>					(0.24)		
Black redhorse	-	-	-	-	<0.01	-	-
<i>Moxostoma duquesnei</i>					(0.65)		
Golden redhorse	-	-	-	-	<0.01	-	-
<i>Moxostoma erythrurum</i>					(0.02)		
Topminnows							
Blackspotted topminnow	-	-	-	-	<0.01	-	-
<i>Fundulus olivaceus</i>					(<0.01)		
Sculpins							
Banded sculpin	-	0.03	<0.01	-	0.03	-	-
<i>Cottus carolinae</i>		(0.25)	(0.05)		(0.16)		
Sunfishes							
Rock bass	-	-	0.02	-	0.01	-	-
<i>Ambloplites rupestris</i>			(0.05)		(0.54)		
Redbreast sunfish	-	<0.01	<0.01	-	0.03	-	-
<i>Lepomis auritus</i>		(0.03)	(<0.01)		(0.33)		
Green sunfish	-	0.07	0.16	-	<0.01	-	-
<i>Lepomis cyanellus</i>		(0.50)	(0.96)		(0.02)		
Hybrid sunfish	-	<0.01	-	-	-	-	-
		(0.06)					
Warmouth	-	-	-	-	<0.01	-	-
<i>Lepomis gulosus</i>					(<0.01)		
Bluegill	-	-	-	-	0.05	0.03	-
<i>Lepomis macrochirus</i>					(0.12)	(0.13)	
Longear sunfish	-	-	-	-	<0.01	-	-
<i>Lepomis megalotis</i>					(0.03)		

Table A.1 (continued)

Perches							
Greenside darter	-	-	-	-	<0.01 (0.01)	-	-
<i>Etheostoma blenniodes</i>							
Blueside darter	-	-	-	-	<0.01 (0.01)	-	-
<i>Etheostoma jessiae</i>							
Stripetail darter	-	0.09 (0.14)	0.11 (0.12)	-	<0.01 (0.01)	0.05 (0.09)	-
<i>Etheostoma kennicotti</i>							
Redline darter	-	-	-	-	<0.01 (0.01)	-	-
<i>Etheostoma rufilineatum</i>							
Snubnose darter	-	0.08 (0.13)	0.01 (0.01)	-	0.04 (0.04)	<0.01 (0.01)	-
<i>Etheostoma simoterum</i>							
TOTAL							
Species richness	2	12	12	2	23	8	3
Density	2.26	1.74	0.67	0.71	0.27	0.14	0.96
Biomass	2.07	6.56	3.88	1.94	3.04	1.50	2.43

Notes: BCK = Bear Creek kilometer; NT3 = Bear Creek North Tributary 3; BFK = Brushy Fork kilometer; MBK = Mill Branch kilometer; PHK = Pinhook Branch kilometer.

Table A.2. Species richness, density (number of fish/m²), and biomass (g/m², in parentheses) for fish community samples from Bear Creek; Bear Creek North Tributary 3; and the reference streams Brushy Fork, Mill Branch, and Pinhook Branch, September/October 2018

Species	BCK 12.4	BCK 9.9	BCK 3.3	NT3	BFK 7.6	MBK 1.6	PHK 1.6
Lampreys							
American brook lamprey	-	-	-	-	0.08 (0.53)	-	-
<i>Lampetra appendix</i>							
Minnows							
Largescale stoneroller	0.21 (0.69)	0.53 (1.50)	0.11 (0.49)	-	0.08 (0.33)	0.05 (0.58)	-
<i>Campostoma oligolepis</i>							
Spotfin shiner	-	-	-	-	<0.01 (0.01)	-	-
<i>Cyprinella spiloptera</i>							
Bigeye chub	-	-	-	-	0.05 (0.10)	-	-
<i>Hybopsis amblops</i>							
Striped shiner	-	0.81 (3.11)	0.10 (0.60)	-	0.22 (1.72)	0.06 (1.02)	-
<i>Luxilus chrysocephalus</i>							
Scarlet shiner	-	-	0.07 (0.17)	-	0.01 (0.03)	-	-
<i>Lythrurus fasciolaris</i>							
Tennessee dace	0.46 (0.41)	<0.01 (0.01)	-	-	-	-	0.78 (1.16)
<i>Chrosomus tennesseensis</i>							
Hybrid Tennessee dace	-	-	-	-	-	-	0.02 (0.03)

Table A.2 (continued)

Species	BCK 12.4	BCK 9.9	BCK 3.3	NT3	BFK 7.6	MBK 1.6	PHK 1.6
Minnows (continued)							
Fathead minnow	-	0.14	-	-	-	-	-
<i>Pimephales promelas</i>		(0.16)					
Western blacknose dace	0.85	0.39	0.04	0.62	<0.01	0.13	1.14
<i>Rhinichthys obtusus</i>	(0.93)	(0.52)	(0.08)	(1.24)	(<0.01)	(0.32)	(1.27)
Creek chub	0.29	0.07	0.01	0.22	0.01	0.05	0.77
<i>Semotilus atromaculatus</i>	(0.76)	(0.67)	(0.09)	(1.14)	(0.02)	(0.57)	(1.68)
Suckers							
White sucker	-	0.05	<0.01	-	<0.01	0.01	-
<i>Catostomus commersonii</i>		(0.67)	(0.01)		(0.05)	(0.53)	
Spotted sucker	-	-	-	-	<0.01	-	-
<i>Minytrema melanops</i>					(0.08)		
Northern hogsucker	-	-	0.03	-	0.04	0.01	-
<i>Hypentelium nigricans</i>			(0.75)		(1.17)	(0.28)	
Black redhorse	-	-	-	-	0.01	-	-
<i>Moxostoma duquesnei</i>					(0.14)		
Golden redhorse	-	-	-	-	<0.01	-	-
<i>Moxostoma erythrurum</i>					(0.08)		
Topminnows							
Blackspotted topminnow	-	-	-	-	<0.01	-	-
<i>Fundulus olivaceus</i>					(0.01)		
Livebearers							
Western mosquitofish	-	-	0.01	-	<0.01	-	-
<i>Gambusia affinis</i>			(<0.01)		(<0.01)		
Sculpins							
Banded sculpin	-	0.04	0.01	-	0.06	-	-
<i>Cottus carolinae</i>		(0.20)	(0.05)		(0.17)		
Sunfishes							
Rock bass	-	0.04	0.01	-	0.01	0.01	-
<i>Ambloplites rupestris</i>		(0.34)	(0.09)		(0.63)	(0.95)	
Redbreast sunfish	-	0.04	0.01	-	0.06	0.01	-
<i>Lepomis auritus</i>		(0.64)	(0.17)		(1.10)	(0.28)	
Green sunfish	-	0.12	0.15	-	0.02	0.01	-
<i>Lepomis cyanellus</i>		(1.25)	(0.98)		(0.17)	(0.37)	
Warmouth	-	-	-	-	-	0.01	-
<i>Lepomis gulosus</i>						(0.20)	
Bluegill	-	-	-	-	0.05	0.15	-
<i>Lepomis macrochirus</i>					(0.51)	(1.53)	
Hybrid sunfish	-	-	-	-	-	0.01	-
						(0.22)	

Table A.2 (continued)

Species	BCK 12.4	BCK 9.9	BCK 3.3	NT3	BFK 7.6	MBK 1.6	PHK 1.6
Sunfishes (continued)							
Spotted bass	-	-	-	-	-	<0.01	-
<i>Micropterus punctulatus</i>						(0.04)	
Largemouth bass	-	-	0.01	-	-	-	-
<i>Micropterus salmoides</i>			(0.05)				
Perches							
Greenside darter	-	-	-	-	<0.01	-	-
<i>Etheostoma blenniodes</i>					(0.05)		
Blueside darter	-	-	-	-	0.02	-	-
<i>Etheostoma jessiae</i>					(0.03)		
Stripetail darter	-	0.11	0.05	-	0.01	0.02	-
<i>Etheostoma kennicotti</i>		(0.10)	(0.04)		(0.01)	(0.01)	
Redline darter	-	-	-	-	0.01	-	-
<i>Etheostoma rufileatum</i>					(0.01)		
Snubnose darter	-	0.10	0.06	-	0.05	-	-
<i>Etheostoma simoterum</i>		(0.13)	(0.06)		(0.05)		
TOTAL							
Species richness	4	13	15	2	25	13	3
Density	1.81	2.45	0.68	0.85	0.80	0.52	2.71
Biomass	2.78	9.30	3.64	2.38	6.98	6.91	4.14

Notes: BCK = Bear Creek kilometer; NT3 = Bear Creek North Tributary 3; BFK = Brushy Fork kilometer; MBK = Mill Branch kilometer; PHK = Pinhook Branch kilometer.

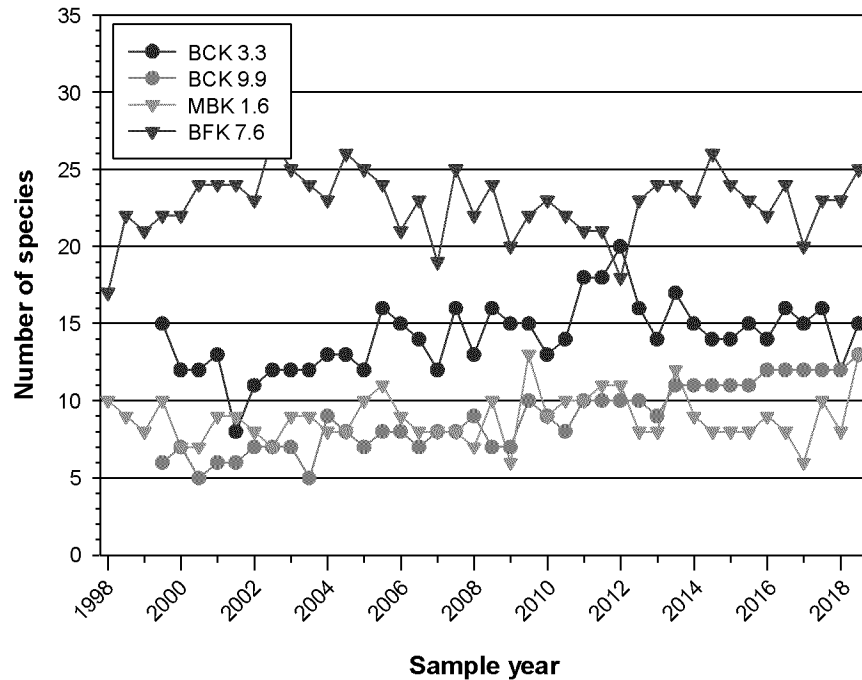


Fig. A.6. Species richness (number of species) in samples of the fish communities in lower to middle Bear Creek and the Brushy Fork and Mill Branch reference streams, 1998–2018.
 Interruptions in data lines indicate no results are available for those periods.
 (Notes: BCK = Bear Creek kilometer; BFK = Brushy Fork kilometer; MBK = Mill Branch kilometer.)

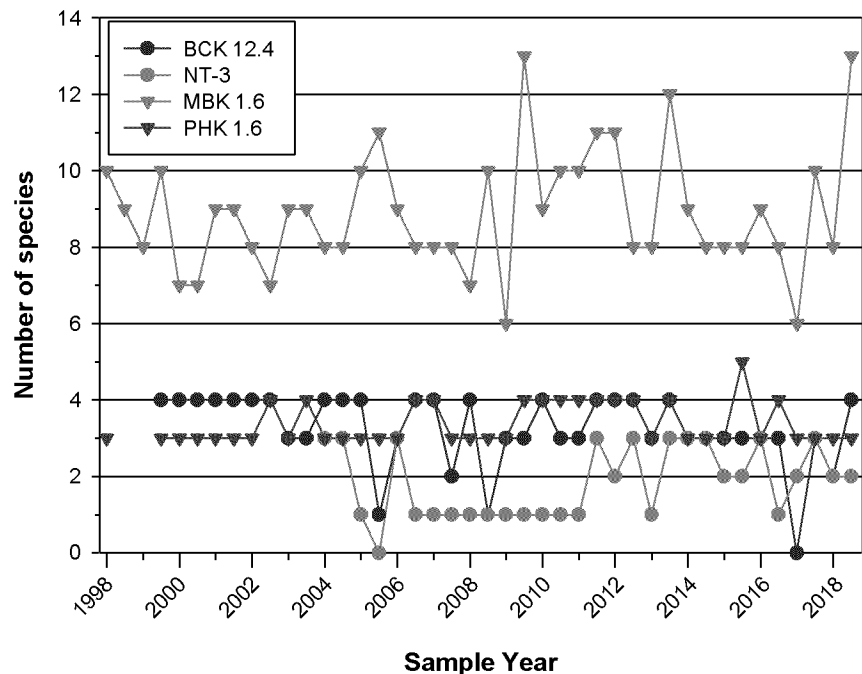


Fig. A.7. Species richness (number of species) in samples of the fish communities in upper Bear Creek, Bear Creek North Tributary 3, and the Mill Branch and Pinhook Branch reference streams, 1998–2018. Interruptions in data lines indicate no results are available for those periods.
 (Notes: BCK = Bear Creek kilometer; NT3 = Bear Creek North Tributary 3; MBK = Mill Branch kilometer; PHK = Pinhook Branch kilometer.)